

98/02313 Performance investigation of a hydroelectric power station at Batang Al-Sarawak

Al-Zubaidy, S. and Rigit, A. *Int. J. Energy Res.*, 1997, 21, (15), 1405-1412. Hydraulic power generator is known to offer one of the cleanest energy supply. However, much emphasis in these plants appears to be directed towards condition monitoring (based on typical weekly and monthly data gathering) and less attention is directed towards continuous performance monitoring. This paper offers an investigative study of the effect of some performance parameters such as inlet and outlet relative flow angles, nozzle angle, hydraulic turbine efficiency on the overall performance of 108 MW station using four identical vertical shaft Francis turbines. The results of the study indicates that for a given energy supply, determined by the available water head, a one percentage point improvement of the turbine efficiency might lead to increased earnings of about 1.25%.

98/02314 Reciprocating steam engine power plants fed by woodwaste

Bidini, G. *et al.* *Int. J. Energy Res.*, 1998, 22, (3), 237-248. Fed by facilitated renewable energy sources like wood waste, reciprocating steam engines can be employed successfully in small size power plants. Reciprocating steam engines, until now employed only in energy short third world countries, has become attractive to developed countries because of growing environmental sensitivity. Application to a real case shows conditions for the economic feasibility of reciprocating steam engine in comparison with the heat based or other cogeneration techniques. An economic analysis is performed by the annual equivalent method and the internal rate of return method.

98/02315 Simulation and analysis of a naturally aspirated IDI diesel engine under transient conditions comprising the effect of various dynamic and thermodynamic parameters

Rakopoulos, C. D. and Giakoumis, E. G. *Energy Convers. Mgmt.*, 1998, 39, (5/6), 465-484.

The operation of an indirect injection, naturally aspirated, diesel engine under transient conditions resulting from a rapid increase in load is analysed in this paper. A single-zone thermodynamic model, following the filling and emptying modelling technique, has been developed, which accounts for all basic parts of the thermodynamic engine operation. The dynamic simulation of the engine is also covered with special submodels to model the conservation of energy in the crankshaft, the inertia forces, the governor dynamics and the fuel pump characteristics. Unlike most previous models, the transient operation is not regarded as a series of steady state operating points, but care has been taken for the special characteristics of this unsteady operation. To this aim, analytical expressions were derived for the better simulation of combustion, mechanical friction and governor movement, which during the transient operation behave in a different way than at steady state. When tested against results derived from detailed experimental work conducted at the authors' laboratory, the model compared favourably. A detailed parametric study was made and analytical diagrams for the effect of the operating parameters on the transient operation of the two typical properties of speed droop and recovery period are given, which quantify each parameter's contribution. The effect of a faulty fuel injection system on one cylinder of the four-cylinder engine has also been studied, providing important information about the engine's non-optimum operation.

11 PROCESS HEATING, POWER AND INCINERATION

Energy Applications in Industry

98/02316 Apparatus for drying iron ore and coke

Tamura, N. *et al.* *Jpn. Kokai Tokkyo Koho JP 09 61,059 [97 61,059]* (Cl. F27B21/00), 7 Mar 1997, Appl. 95/220,460, 29 Aug 1995, 5 pp. (In Japanese)

A burner, a combustion chamber, and a mixing chamber are included for the preparation of a hot blast. Also, there is a dryer and a hot blast circulating line consisting of a dust catcher, duct and provisions for suction of air into the circulating line before and after the dust catcher to dilute the hot blast to decrease the dew point of the blast for dryness.

98/02317 Briquetting of electric-arc furnace dust with coal fines for smelting with recovery of iron and zinc

Myerson, A. S. and Robinson, P. *PCT Int. Appl. WO 97 49,637* (Cl. C01G9/00), 31 Dec 1997, US Appl. 672,103, 27 Jun 1996, 48 pp.

The iron-containing dust wastes from electric-arc furnaces are briquetted with coal fines, and charged into a furnace for smelting with the associated recovery of vaporized zinc, lead, and cadmium values as well as the

recycling of iron-rich solids to steelmaking. The dust-waste briquettes are charged into a furnace along with a scrap melting charge, and the vaporized crude zinc is condensed and recovered by leaching and precipitation to obtain zinc oxide. The crude zinc oxide is typically dissolved in concentrated aqueous NaOH, followed by dilution of the filtered solution to precipitate the purified ($\geq 99.8\%$) zinc oxide. The iron-containing residual solids are typically recycled to the briquetting mix for enrichment, then fed into a furnace for direct reduction or oxide smelting.

98/02318 Coke for cupola

Kawamura, T. *et al.* *Jpn. Kokai Tokkyo Koho JP 09,310,074 [97,310,074]* (Cl. C10B53/08), 2 Dec 1997, Appl. 96/148,552, 21 May 1996, 5 pp. (In Japanese)

As a major fuel for melting cold iron charge, cupola coke (metallurgical) is coated with a glaze (melting point 1000-1400°C) or melted steelmaking slag. Prior to glazing, the metallurgical coke is coated with a calcium compound on the matrix.

98/02319 Combustion and gasification behaviors of plastics injected into raceway of blast furnace

Asanuma, M. *et al.* *Tetsu to Hagane*, 1997, 83, (10), 617-622. (In Japanese)

The drop tube furnace, raceway hot model and scrap melting shaft furnace have been used to examine the combustion and gasification behaviours of plastics. Observation of combustion of a single plastic by the drop tube furnace experiments under around 1200°C showed the burning rate of coarse plastic was slower than that of pulverized coal. On the contrary, in the raceway hot model and scrap melting shaft furnace with the plastics injection, the combustion efficiency of plastics was much higher than that of pulverized coal in spite of coarse particle. Moreover, the gas composition and temperature distribution in the raceway during the plastics injection were similar to those of all coke operation. The combustion mechanism of coarse plastics was different from that of pulverized coal. The residence time of coarse plastics in the raceway was estimated to be longer than that of pulverized coal or fine particle, based on the findings of the study. The circulation model of coarse plastic particle in the raceway was newly investigated, and the combustion efficiency of plastics was theoretical evaluated. The results calculated by the circulation model agreed with those of the hot model experiments.

98/02320 Development of high power oxy-coal burner

Dong, Y. and Song, Y. *Gangtie Yanjiu Xuebao*, 1997, 9, (5), 63-65. (In Chinese)

A highly heat resistant and low wear high power oxy-coal burner has been developed by advanced designing. It is characterized by high burn-out, high injection rate and testing in a blast furnace of the Baotou Steel Works reveals long service life.

98/02321 Device and process for blowing coal into shaft furnace

Langer, K. *et al.* *PCT Int. Appl. WO 97 46,718* (Cl. C21B5/00), 11 Dec 1997, LU Appl. 88,763, 30 May 1996, 20 pp. (In German)

A carrier gas is used to feed the coal dust into the shaft furnace through a feed line. The coal dust is preheated, preferably in several stages, in a plurality of consecutively arranged containers equipped with heating elements.

98/02322 Effect of coal type on coal-based direct reduction of low grade iron ore

Zhang, Q. *et al.* *Zhongnon Gongye Daxue Xuebao*, 1997, 28, (2), 126-129. (In Chinese)

The paper studies the effect of five types of coal on the coal-based direct reduction of low-grade iron ore. The reactivity, ash content, and volatile content of coal showed a significant effect on the total iron content of the direct reduced iron, the metallization rate of the iron ore and the degree of reduction. Under optimal conditions, the grade of direct reduced iron $> 91\%$, metallization rate $> 92\%$ and iron recovery $> 68\%$ can be obtained.

98/02323 Effect of nonuniformity of the distribution of coal dust with respect to tuyeres on the nature of temperature fields in a blast furnace

Dmitriev, A. N. and Shavrin, S. V. *Isv. Vyssh. Uchebn. Zaved., Chern. Metall.*, 1997, (5), 74-75. (In Russian)

For a 1719 m³ furnace, the temperature fields are presented at various pulverized coal rates. Decreasing the coal injection increases the temperature at the tuyere because of increased coke combustion.

98/02324 Effect of oxygen content in the blast on the nature of temperature fields in a blast furnace during injection of coal dust

Dmitriev, A. N. and Shavrin, S. V. *Izv. Vyssh. Uchebn. Zaved., Chern. Metall.*, 1997, (7), 81-82. (In Russian)

The effect of the oxygen content on the temperature distribution and pulverized coal consumption in an iron-making blast furnace was determined with a mathematical model. The temperature distribution data are presented in graphical form. At increased pulverized coal injection rate, the increase of oxygen concentration in the blast and its increased